Cartesian Diver

What is needed (get help from an adult for all of this…plus its fun to do these activities together!)

- Condiment Packet (Ketchup, mayo or mustard from a fast food restaurant is what we use)
- Two liter bottle, or a smaller water bottle

What to do
Fill the bottle all the way to the top, and place the condiment packet in the bottle. Screw the top of the bottle on, hard. If the packet floats, you are probably OK. If it sinks, you are going to need to try a different packet. Ketchup packets seem to work well, so you may need to try something else depending on what part of the country you live in - your local air pressure makes a difference!

Next, squeeze the bottle. If you squeeze it hard enough, the packet should sink. If you can't make it sink (mayonnaise packets seem to float no matter how hard you squeeze), you will need to try another packet.

Once you get just the right packet, it will float when you aren't squeezing the bottle, and sink when you do. You can make it go up and down with very little effort.

What is happening?
There is a small air bubble inside the packet. When the packet is inside the bottle and you are not squeezing, the bubble is large enough that it will make the packet float very nicely. However, when you squeeze the bottle, you increase the pressure inside the bottle. This will compress the air bubble, which will increase the density of the packet. The packet will now sink.

Submarines use a similar principle to control their buoyancy, as do some fish.

Other things to try
This experiment is also affected by temperature…why? Go try—Leave the bottle out side overnight. When the bottle gets too cold, the packet will not float any more. Can you see why this might happen?

The packet also floats or sinks depending on air pressure - which varies with altitude. The expedition team for Mars Underwater is living at 14,000 feet. What do you think would happen if you did this at the refuge? How about at sea level?